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(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

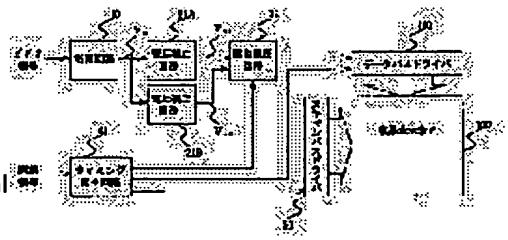
(72)Inventor : FURUBAYASHI YOSHINORI

(54) LIQUID CRYSTAL DISPLAY DEVICE AND DRIVE METHOD THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce the deterioration in a gradation display such as a black painted-out phenomenon and an inversion phenomenon, etc., and to obtain an improved visual angle characteristic even when a liquid crystal display element is a large screen panel.

SOLUTION: This device is provided with two kinds of voltage correction circuits 21A, 21B having input/output characteristics different from each other, and a drive voltage circuit 31 is constituted so that it inputs the outputs VyA, VyB of the voltage correction circuits 21A, 21B and switch outputs inverted or noninverted VyA, VyB so as to apply from a data bus driver 110 at every prescribed pixel arranged in matrix on the liquid crystal display element 100. By selecting the outputs of the voltage correction circuits 21A, 21B at every prescribed pixel, since the characteristics of two kinds of voltage correction circuits 21A, 21B are synthesized visually, the deterioration in the gradation display such as the black painted-out phenomenon and the inversion phenomenon, etc., is reduced, and the visual characteristic is improved even when the liquid crystal display element 100 is a large screen panel.



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CLAIMS

[Claim(s)]
[Claim 1] The actuation approach of the liquid crystal display characterized by impressing selectively two or more applied voltage generated by two or more conversion approaches which are the actuation approaches of a liquid crystal display of arranging a pixel in the shape of a matrix, and driving a liquid crystal display component with the nonlinear relation of the brightness to applied voltage, and are changed into different applied voltage to the input signal of the same level to said pixel.
[Claim 2] The actuation approach of a liquid crystal display according to claim 1 of impressing the applied voltage generated by the same conversion approach to the pixel arranged in matrix-like the same line or the same train.
[Claim 3] The liquid crystal display characterized by establishing two or more conversion means to be the liquid crystal displays which have arranged the pixel in the shape of a matrix, and were equipped with the liquid crystal display component with the nonlinear relation of the brightness to applied voltage, and to change into different applied voltage to the input signal of the same level, and the change means for impressing selectively two or more applied voltage changed with two or more of these conversion means to said pixel.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the actuation approach of a liquid crystal display and liquid crystal display which perform a gradation display.
[0002]
[Description of the Prior Art] A liquid crystal display (LCD) is expanding the need increasingly from the descriptions, such as a thin shape and power saving. Drawing 5 is the block diagram of the conventional liquid crystal display, and is the example of the video presentation equipments for television etc.
[0003] The liquid crystal display component 100 with the nonlinear relation of brightness [as opposed to / this conventional liquid crystal display arranges a pixel in the shape of a matrix, and / applied voltage], An input video signal is amplified on predetermined level, a predetermined level shift is performed, and it

is the magnification video signal Vx. The amplifying circuit 10 to output, Magnification video signal Vx It changes into the gamma property of the liquid crystal display component 100, and is the gamma conversion video signal Vy. The electrical-potential-difference amendment circuit 20 to output, Gamma conversion video signal Vy The driver voltage circuit 30 which reverses a polarity with a predetermined period, The data bus driver 110 which undergoes the output and impresses a signal level to the liquid crystal display component 100, The scanning bus driver 120 which impresses a scan electrical potential difference to the liquid crystal display component 100, Consist of a timing generating circuit 40 which the driver voltage circuit 30, the data bus driver 110, and the scanning bus driver 120 are synchronized with a video signal, and drives them. (For example, volume for television institutes, and Ogoshi **** editorial-supervision "liquid crystal display" chapter 7 Section 5 p.221-p. 226, Shokodo, Showa 60) .

[0004] Here, the liquid crystal display component 100 is a liquid crystal display component of an active-matrix mold, has arranged the polarizing plate on both sides on both sides of the liquid crystal display component 100, when an electrical potential difference was not impressed to a liquid crystal layer, it changed into the "**" condition, and when an electrical potential difference is impressed, the polarization shaft of a polarizing plate is set as the no MARI White mode which will be in a "dark" condition. About one display pixel of the liquid crystal display component 100 in the conventional liquid crystal display set as this no MARI White mode, a gamma property (a "V-T property" is called below), i.e., the brightness (equivalent to permeability) property over applied voltage, is shown in drawing 6 . Drawing 6 (a) is a V-T property at the time of seeing from the front (the direction of a normal, theta= 0 degree) of a liquid crystal display, and drawing 6 (b) is a V-T property at the time of leaning and seeing a view at theta= 30 degrees of down [of a liquid crystal display].

[0005] As shown in drawing 6 , when indicating by 8 gradation in the conventional liquid crystal display, it sees from the front (theta= 0 degree) first, and applied-voltage level (V1, V2, ..., V8) is set up to each intensity level (B1, B-2, ..., B8) which divided brightness the 8th grade and divided it. On the other hand, when 30 degrees of views are leaned downward, as shown in drawing 6 (b), while shifting a V-T property to a low-battery side compared with the case of theta= 0 degree, a new peak appears in a high-tension side. if the intensity level (B1', B-2', ..., B8 — ') to each applied-voltage level (V1, V2, ..., V8) is looked at in this condition, in a high brightness field (low applied-voltage field), the difference between intensity levels will become large, and the difference between intensity levels will become small in a low brightness field (high applied-voltage field). Visually, this is visible as a very dark image compared with the image seen from the transverse plane (a black crushing phenomenon is called). Furthermore, when the relation of the intensity level in the applied-voltage level V7 and V8 sees from the front (theta= 0 degree), it has reversed. This is called a tone reversal phenomenon and is visually visible as an image like the negative of a photograph.

[0006]

[Problem(s) to be Solved by the Invention] As mentioned above, in the conventional liquid crystal display, when the view was leaned, a gradation display got worse considerably and especially video presentation, such as television, was performed, reversal etc. was remarkable, the display property changed and there was a problem that a viewing-angle property was bad. Moreover, even if a view will be restricted, and it restricted the view further when it was a big screen panel in order to prevent change of a display property, since the viewing angle between the vertical edges of a viewing area became large, it had the problem that display properties will differ greatly by the upper and lower sides of a display.

[0007] This invention reduces aggravation of gradation displays, such as a black crushing phenomenon and reversal, in view of this point, and even if a liquid crystal display component is a big screen panel, it aims at offering the actuation approach of a liquid crystal display and liquid crystal display which can improve a viewing-angle property.

[0008]

[Means for Solving the Problem] The actuation approach of a liquid crystal display according to claim 1 is the actuation approach of a liquid crystal display of arranging a pixel in the shape of a matrix, and

driving a liquid crystal display component with the nonlinear relation of the brightness to applied voltage, and is characterized by impressing selectively to a pixel two or more applied voltage generated by two or more conversion approaches changed into different applied voltage to the input signal of the same level. Thereby, since the property of two or more conversion approaches is compounded visually, even if a liquid crystal display component is a big screen panel, a vision property is improvable [aggravation of gradation displays, such as a black crushing phenomenon and reversal, is reduced, and].

[0009] He is trying for the actuation approach of a liquid crystal display according to claim 2 to impress the applied voltage generated by the same conversion approach in the actuation approach of a liquid crystal display according to claim 1 to the pixel arranged in matrix-like the same line or the same train. A liquid crystal display according to claim 3 is a liquid crystal display which has arranged the pixel in the shape of a matrix, and was equipped with the liquid crystal display component with the nonlinear relation of the brightness to applied voltage, and is characterized by establishing two or more conversion means to change into different applied voltage to the input signal of the same level, and the change means for impressing selectively to a pixel two or more applied voltage changed with two or more of these conversion means. Thereby, since the property of two or more conversion means is compounded visually, even if a liquid crystal display component is a big screen panel, a vision property is improvable [aggravation of gradation displays, such as a black crushing phenomenon and reversal, is reduced, and].

[0010]

[Embodiment of the Invention] Drawing 1 is the block diagram of the liquid crystal display of the gestalt of implementation of this invention. In drawing 1 , 10 amplifies an input video signal on predetermined level, a predetermined level shift is performed, and it is the magnification video signal Vx. The amplifying circuit to output, 21A and 21B are the magnification video signal Vx. The electrical-potential-difference amendment circuit which changes into the gamma property of the liquid crystal display component 100, and outputs a gamma conversion video signal (VyA, VyB), The driver voltage circuit which carries out the change output of one of these while 31 reverses the polarity of the gamma conversion video signals VyA and VyB with a predetermined period, 41 is a timing generating circuit which the driver voltage circuit 31, the data bus driver 110, and the scanning bus driver 120 are synchronized with a video signal, and drives them. The liquid crystal display component 100, the data bus driver 110, and the scanning bus driver 120 are the same configurations as the conventional liquid crystal display shown in drawing 5 .

[0011] This liquid crystal display has formed two kinds of electrical-potential-difference amendment circuits 21A and 21B which have different input-output behavioral characteristics, and the driver voltage circuit 31 inputs the outputs VyA and VyB of the electrical-potential-difference amendment circuits 21A and 21B, and it carries out a change output so that reversal or noninverting VyAVyB can be impressed for every predetermined pixel arranged in the shape of [of the liquid crystal display component 100] a matrix from the data bus driver 110. In addition, the electrical-potential-difference amendment circuits 21A and 21B were equivalent to the conversion means (claim 3), and the driver voltage circuit 31 serves as the change means (claim 3).

[0012] Drawing 2 is input-output-behavioral-characteristics drawing of two kinds of electrical-potential-difference amendment circuits 21A and 21B, Curve A shows the input-output behavioral characteristics of electrical-potential-difference amendment circuit 21A, and Curve B shows the input-output behavioral characteristics of electrical-potential-difference amendment circuit 21B. Here, the input-output behavioral characteristics of the electrical-potential-difference amendment circuits 21A and 21B are set up, for example so that the average may become a desired property. Moreover, drawing 3 is drawing showing the brightness to the video signal of an input of this liquid crystal display, drawing 3 (a) shows the property at the time of seeing from the front (theta= 0 degree) of a liquid crystal display, and drawing 3 (b) shows the property at the time of leaning and seeing a view at theta= 30 degrees of down [of a liquid crystal display].

[0013] Here, the brightness to the video signal at the time of presupposing that the driver voltage circuit 31 always outputs reversal and the noninverted signal of the output VyA of electrical-potential-

difference amendment circuit 21A serves as the dotted line A of drawing 3 (a) and (b) (namely, when there is no electrical-potential-difference amendment circuit 21B). Moreover, the brightness to the video signal at the time of presupposing that the driver voltage circuit 31 always outputs reversal and the noninverted signal of the output VyB of electrical-potential-difference amendment circuit 21B serves as the broken line B of drawing 3 (a) and (b) (namely, when there is no electrical-potential-difference amendment circuit 21A).

[0014] With the gestalt of this operation, when the driver voltage circuit 31 carries out the change output of the outputs VyA and VyB of reversal or the noninverting electrical-potential-difference amendment circuits 21A and 21B for every predetermined pixel, as shown in drawing 3 (a) and (b), the "composite" property that the property of a dotted line A and a broken line B was equalized is acquired. Drawing 4 shows the example of a pattern which chooses the electrical-potential-difference amendment circuits 21A and 21B for every predetermined pixel, and drawing 4 (a) is the case where drawing 4 (c) switches the electrical-potential-difference amendment circuits 21A and 21B for every dot for every vertical lines for every level line in drawing 4 (b). In addition, in drawing 4 , the pixel as which A chose electrical-potential-difference amendment circuit 21A, and B are the pixels which chose electrical-potential-difference amendment circuit 21B.

[0015] As mentioned above, according to the gestalt of this operation, two kinds of electrical-potential-difference amendment circuits 21A and 21B which have different input-output behavioral characteristics are formed. The outputs VyA and VyB of reversal or the noninverting electrical-potential-difference amendment circuits 21A and 21B for example, by choosing for every predetermined pixel, as shown in drawing 4 If the resolution of the liquid crystal display component 100 is comparatively high, since the property of two kinds of electrical-potential-difference amendment circuits 21A and 21B will be compounded visually, aggravation of gradation displays, such as a black crushing phenomenon and reversal, is reduced, and a vision property is improvable even if the liquid crystal display component 100 is a big screen panel. Since it generates only in "dark" viewport, especially the reversal in video presentation etc. is changing the property only by the side of the "dark" signal (VxL) of drawing 2 , and it can reduce reversal, without reducing resolution other than "dark" viewport. When the view shown by drawing 3 (b) is theta= 30 degrees, reversal is decreasing [the direction of a "composite" property] compared with the property of A and B.

[0016] Moreover, since a viewing-angle property can be improved and reduction of the reversal in "dark" viewport is attained especially, without changing the configuration of the liquid crystal display component 100, it becomes possible to use the same property and the liquid crystal display component of a configuration for the liquid crystal display from which a demand differs a viewing-angle property and resolution by applications, such as the content of a display, and the practical effectiveness is large. In addition, the selection pattern of the electrical-potential-difference amendment circuits 21A and 21B chosen for every property of the electrical-potential-difference amendment circuits 21A and 21B and predetermined pixel may be changed by the content of a display, and the application.

[0017] Moreover, although the electrical-potential-difference amendment circuits 21A and 21B were made into two kinds, two or more kinds of electrical-potential-difference amendment circuits may be used. For example, as long as it is the liquid crystal display component which arranged the RGB light filter vertically or horizontally, three kinds of electrical-potential-difference amendment circuits may be used for every color configuration unit. Moreover, it is also possible amendment of a V-T property and to use a ROM table to digital signals, such as an object for personal computers and a video signal with which A/D conversion was given, that it is not limited to the electrical-potential-difference amendment circuits 21A and 21B, and two or more kinds of brightness properties over an input signal should just be acquired.

[0018] In addition, in the gestalt of the above-mentioned implementation, although the status signal was made into the video signal, it may not be limited to a video signal and digital data, such as a personal computer, are sufficient.

[0019]
[Effect of the Invention] Since the property of two or more conversion approaches is visually compounded by impressing selectively to a pixel two or more applied voltage generated by two or more conversion approaches changed into different applied voltage to the input signal of the same level according to this invention as explained above, aggravation of gradation displays, such as a black crushing phenomenon and reversal, is reduced, and a vision property is improvable even if a liquid crystal display component is a big screen panel. Moreover, since a viewing-angle property can be improved and reduction of the reversal in "dark" viewport is attained especially, without changing the configuration of a liquid crystal display component, it becomes possible to use the same property and the liquid crystal display component of a configuration for the liquid crystal display from which a demand differs a viewing-angle property and resolution by applications, such as the content of a display, and the practical effectiveness is large.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the liquid crystal display of the gestalt of implementation of this invention.
[Drawing 2] Input-output-behavioral-characteristics drawing of the electrical-potential-difference amendment circuit in the gestalt of implementation of this invention.
[Drawing 3] Drawing showing the brightness to the video signal of the input of the liquid crystal display of the gestalt of operation of this invention.
[Drawing 4] Drawing showing the example of a pattern which chooses an electrical-potential-difference amendment circuit which is different for every predetermined pixel in the gestalt of implementation of this invention.
[Drawing 5] The block diagram of the conventional liquid crystal display.
[Drawing 6] V-T property drawing of the liquid crystal display component in the conventional example.
[Description of Notations]
10 Amplifying Circuit
21A, 21B Electrical-potential-difference amendment circuit
31 Driver Voltage Circuit
41 Timing Generating Circuit
100 Liquid Crystal Display Component
110 Data Bus Driver
120 Scanning Bus Driver

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(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地

(72)発明者　古林　好則
大阪府門真市大字門真1006番地　松下電器産業株式会社内

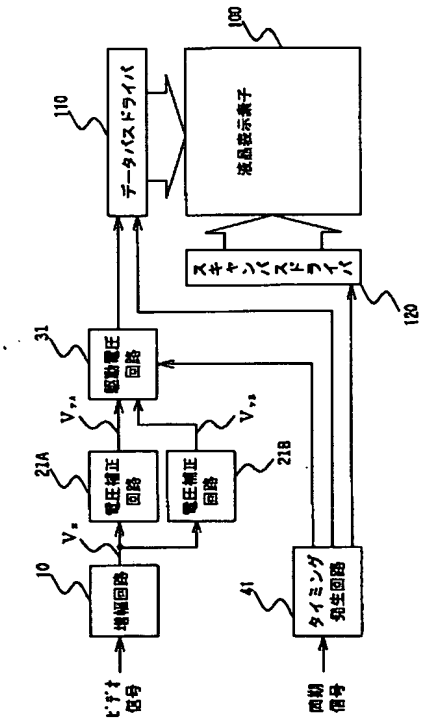
(74)代理人　弁理士　宮井　暎夫

(54)【発明の名称】　液晶表示装置の駆動方法および液晶表示装置

(57)【要約】

【課題】　黒つぶれ現象や反転現象等の階調表示の悪化を低減し、液晶表示素子が大画面パネルであっても改善された視角特性を得る。

【解決手段】　異なる入出力特性を有する２種類の電圧補正回路２１Ａ，２１Ｂを設けてあり、駆動電圧回路３１は、電圧補正回路２１Ａ，２１Ｂの出力V_{yA}，V_{yB}を入力し、反転あるいは非反転のV_{yA}，V_{yB}を、データバスドライバ１１０から液晶表示素子１００のマトリクス状に配置された所定の画素毎に印加できるように、切換え出力するようになっている。電圧補正回路２１Ａ，２１Ｂの出力を所定の画素毎に選択することにより、２種類の電圧補正回路２１Ａ，２１Ｂの特性が視覚的に合成されるため、黒つぶれ現象や反転現象等の階調表示の悪化を低減し、液晶表示素子１００が大画面パネルであっても視覚特性を改善することができる。



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【特許請求の範囲】

【請求項１】　マトリクス状に画素を配置し印加電圧に対する輝度の関係が非線形な液晶表示素子を駆動する液晶表示装置の駆動方法であって、

同一レベルの入力信号に対して異なる印加電圧に変換する複数の変換方法により生成した複数の印加電圧を、前記画素に選択的に印加することを特徴とする液晶表示装置の駆動方法。

【請求項２】　マトリクス状の同じ行または同じ列に配置した画素には、同一の変換方法により生成した印加電圧を印加する請求項１記載の液晶表示装置の駆動方法。

【請求項３】　マトリクス状に画素を配置し印加電圧に対する輝度の関係が非線形である液晶表示素子を備えた液晶表示装置であって、

同一レベルの入力信号に対して異なる印加電圧に変換する複数の変換手段と、

この複数の変換手段により変換した複数の印加電圧を前記画素に選択的に印加するための切換え手段とを設けたことを特徴とする液晶表示装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、階調表示を行う液晶表示装置の駆動方法および液晶表示装置に関するものである。

【０００２】

【従来の技術】液晶表示装置（ＬＣＤ）は、薄型，省電力といった特徴から、その需要はますます拡大しつつある。図５は従来の液晶表示装置の構成図であり、テレビジョン用等のビデオ表示装置の例である。

【０００３】この従来の液晶表示装置は、マトリクス状に画素を配置し印加電圧に対する輝度の関係が非線形である液晶表示素子１００と、入力ビデオ信号を所定のレベルに増幅し所定のレベルシフトを行い増幅ビデオ信号V_Xを出力する増幅回路１０と、増幅ビデオ信号V_Xを液晶表示素子１００のガンマ特性に変換しガンマ変換ビデオ信号V_yを出力する電圧補正回路２０と、ガンマ変換ビデオ信号V_yの極性を所定の周期で反転する駆動電圧回路３０と、その出力を受け液晶表示素子１００に信号電圧を印加するデータバスドライバ１１０と、液晶表示素子１００に走査電圧を印加するスキャンバスドライバ１２０と、駆動電圧回路３０，データバスドライバ１１０およびスキャンバスドライバ１２０をビデオ信号と同期させて駆動するタイミング発生回路４０とからなる（例えば、テレビジョン学会編，大越孝敬監修「液晶ディスプレイ」第７章第５節ｐ．２２１～ｐ．２２６，昭晃堂，昭和６０年）。

【０００４】ここで、液晶表示素子１００は、アクティブマトリックス型の液晶表示素子であり、液晶表示素子１００を挟んで両側に偏光板を配置し、液晶層に電圧が印加されない時に「明」状態となり、電圧が印加された

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時に「暗」状態となるノーマリーホワイトモードに、偏光板の偏光軸を設定している。このノーマリーホワイトモードに設定した従来の液晶表示装置における液晶表示素子１００の１つの表示画素について、ガンマ特性すなわち印加電圧に対する輝度（透過率に相当）特性（以下「Ｖ－Ｔ特性」と称す）を、図６に示す。図６（ａ）は液晶表示装置の真正面（法線方向，$\theta=0°$）から見た場合のＶ－Ｔ特性で、図６（ｂ）は液晶表示装置の下方向$\theta=30°$に視点を傾けて見た場合のＶ－Ｔ特性である。

【０００５】図６に示すように、従来の液晶表示装置において８階調表示をさせるとき、まず真正面（$\theta=0°$）から見て輝度を８等分割し、分割した各々の輝度レベル（B1，B2，・・・・，B8）に対して、印加電圧レベル（V1，V2，・・・・，V8）を設定する。一方、視点を下方向に３０°傾けた場合、図６（ｂ）に示すようにＶ－Ｔ特性は$\theta=0°$の場合に比べて低電圧側にシフトするとともに、高電圧側に新たなピークが現れる。この状態で各印加電圧レベル（V1，V2，・・・・，V8）に対する輝度レベル（B1′，B2′，・・・・，B8′）を見てみると、高輝度領域（低印加電圧領域）では輝度レベル間の差が大きくなり、低輝度領域（高印加電圧領域）では輝度レベル間の差が小さくなる。これは目視では、正面から見た画像に比べて非常に暗い画像として見える（黒つぶれ現象と称す）。さらに、印加電圧レベルV7とV8における輝度レベルの関係が真正面（$\theta=0°$）から見た場合とは逆転している。これは階調反転現象と呼ばれ、目視では写真のネガのような画像として見える。

【０００６】

【発明が解決しようとする課題】以上のように、従来の液晶表示装置では、視点を傾けると、階調表示がかなり悪化し、特にテレビジョン等のビデオ表示を行う場合、反転現象などが著しく、表示特性が変化し、視角特性が悪いという問題があった。また、表示特性の変化を防ぐためには、視点を制限されてしまい、さらに、大画面パネルであれば、視点を制限しても、表示領域の上下端間の視角が大きくなるために表示の上下で表示特性が大きく異なってしまうという問題を有していた。

【０００７】この発明はかかる点に鑑み、黒つぶれ現象や反転現象等の階調表示の悪化を低減し、液晶表示素子が大画面パネルであっても視角特性を改善できる液晶表示装置の駆動方法および液晶表示装置を提供することを目的とする。

【０００８】

【課題を解決するための手段】請求項１記載の液晶表示装置の駆動方法は、マトリクス状に画素を配置し印加電圧に対する輝度の関係が非線形な液晶表示素子を駆動する液晶表示装置の駆動方法であって、同一レベルの入力信号に対して異なる印加電圧に変換する複数の変換方法により生成した複数の印加電圧を、画素に選択的に印加

することを特徴とする。これにより、複数の変換方法の特性が視覚的に合成されるため、黒つぶれ現象や反転現象等の階調表示の悪化を低減し、液晶表示素子が大画面パネルであっても視覚特性を改善することができる。

【０００９】請求項２記載の液晶表示装置の駆動方法は、請求項１記載の液晶表示装置の駆動方法において、マトリクス状の同じ行または同じ列に配置した画素には、同一の変換方法により生成した印加電圧を印加するようにしている。請求項３記載の液晶表示装置は、マトリクス状に画素を配置し印加電圧に対する輝度の関係が非線形である液晶表示素子を備えた液晶表示装置であって、同一レベルの入力信号に対して異なる印加電圧に変換する複数の変換手段と、この複数の変換手段により変換した複数の印加電圧を画素に選択的に印加するための切換え手段とを設けたことを特徴とする。これにより、複数の変換手段の特性が視覚的に合成されるため、黒つぶれ現象や反転現象等の階調表示の悪化を低減し、液晶表示素子が大画面パネルであっても視覚特性を改善することができる。

【００１０】

【発明の実施の形態】図１はこの発明の実施の形態の液晶表示装置の構成図である。図１において、１０は入力ビデオ信号を所定のレベルに増幅し所定のレベルシフトを行い増幅ビデオ信号V_Xを出力する増幅回路、２１Ａ，２１Ｂは増幅ビデオ信号V_Xを液晶表示素子１００のガンマ特性に変換しガンマ変換ビデオ信号（V_{yA}，V_{yB}）を出力する電圧補正回路、３１はガンマ変換ビデオ信号V_{yA}，V_{yB}の極性を所定の周期で反転するとともにその一方を切換え出力する駆動電圧回路、４１は駆動電圧回路３１，データバスドライバ１１０およびスキャンバスドライバ１２０をビデオ信号と同期させて駆動するタイミング発生回路である。液晶表示素子１００，データバスドライバ１１０およびスキャンバスドライバ１２０は、図５に示す従来の液晶表示装置と同様の構成である。

【００１１】この液晶表示装置は、異なる入出力特性を有する２種類の電圧補正回路２１Ａ，２１Ｂを設けてあり、駆動電圧回路３１は、電圧補正回路２１Ａ，２１Ｂの出力V_{yA}，V_{yB}を入力し、反転あるいは非反転のV_{yA}，V_{yB}を、データバスドライバ１１０から液晶表示素子１００のマトリクス状に配置された所定の画素毎に印加できるように、切換え出力するようになっている。なお、電圧補正回路２１Ａ，２１Ｂが変換手段（請求項３）に相当し、駆動電圧回路３１が切換え手段（請求項３）を兼ねている。

【００１２】図２は２種類の電圧補正回路２１Ａ，２１Ｂの入出力特性図であり、曲線Ａが電圧補正回路２１Ａの入出力特性を示し、曲線Ｂが電圧補正回路２１Ｂの入出力特性を示す。ここで、電圧補正回路２１Ａ，２１Ｂの入出力特性は、例えば、その平均値が所望の特性になるように設定する。また、図３はこの液晶表示装置の入力のビデオ信号に対する輝度を示す図であり、図３（ａ）は液晶表示装置の真正面（$\theta=0°$）から見た場合の特性を示し、図３（ｂ）は液晶表示装置の下方向$\theta=30°$に視点を傾けて見た場合の特性を示す。

【００１３】ここで、駆動電圧回路３１が常に電圧補正回路２１Ａの出力V_{yA}の反転・非反転信号を出力するとした場合（すなわち電圧補正回路２１Ｂがない場合）のビデオ信号に対する輝度は、図３（ａ），（ｂ）の点線Ａとなる。また、駆動電圧回路３１が常に電圧補正回路２１Ｂの出力V_{yB}の反転・非反転信号を出力するとした場合（すなわち電圧補正回路２１Ａがない場合）のビデオ信号に対する輝度は、図３（ａ），（ｂ）の破線Ｂとなる。

【００１４】この実施の形態では、駆動電圧回路３１が、反転あるいは非反転の電圧補正回路２１Ａ，２１Ｂの出力V_{yA}，V_{yB}を所定の画素毎に切換え出力することにより、図３（ａ），（ｂ）に示すように、点線Ａと破線Ｂの特性が平均化された「合成」の特性が得られる。図４は所定の画素毎に電圧補正回路２１Ａ，２１Ｂを選択するパターン例を示し、図４（ａ）は水平ライン毎に、図４（ｂ）は垂直ライン毎に、図４（ｃ）は１ドット毎に、電圧補正回路２１Ａ，２１Ｂを切り換えた場合である。なお、図４において、Ａは電圧補正回路２１Ａを選択した画素、Ｂは電圧補正回路２１Ｂを選択した画素である。

【００１５】以上のように、この実施の形態によれば、異なる入出力特性を有する２種類の電圧補正回路２１Ａ，２１Ｂを設け、反転あるいは非反転の電圧補正回路２１Ａ，２１Ｂの出力V_{yA}，V_{yB}を、例えば図４に示すように所定の画素毎に選択することにより、液晶表示素子１００の解像度が比較的高ければ、２種類の電圧補正回路２１Ａ，２１Ｂの特性が視覚的に合成されるため、黒つぶれ現象や反転現象等の階調表示の悪化を低減し、液晶表示素子１００が大画面パネルであっても視覚特性を改善することができる。特に、ビデオ表示等における反転現象は「暗」表示域のみで発生することから、図２の「暗」信号（V_{XL}）側のみの特性を変えることで、「暗」表示域以外の解像度を低下させることなしに反転現象を低減できる。図３（ｂ）で示す視点が$\theta=30°$の場合、Ａ，Ｂの特性に比べて「合成」の特性の方が反転現象が低減している。

【００１６】また、液晶表示素子１００の構成を変えることなしに視角特性を改善でき、特に「暗」表示域での反転現象の低減が可能となるため、表示内容等用途により視角特性や解像度を要求が異なる液晶表示装置に、同一の特性，構成の液晶表示素子を用いることが可能となり、その実用的効果は大きい。なお、電圧補正回路２１Ａ，２１Ｂの特性および所定の画素毎に選択する電圧補正回路２１Ａ，２１Ｂの選択パターンを表示内容、用途

によって変更してもよい。

【００１７】また、電圧補正回路２１Ａ，２１Ｂを２種類としたが、２種類以上の電圧補正回路を用いてもよい。例えば、垂直または水平方向にＲＧＢカラーフィルタを配列した液晶表示素子であれば、カラー構成単位毎に、３種類の電圧補正回路を用いてもよい。また、Ｖ－Ｔ特性の補正も、電圧補正回路２１Ａ，２１Ｂに限定されるものでなく、入力信号に対する輝度特性が２種類以上得られればよく、パソコン用や、Ａ／Ｄ変換の施されたビデオ信号等のディジタル信号に対してはＲＯＭテーブルを用いることも可能である。

【００１８】なお、上記実施の形態において、表示信号をビデオ信号としたが、ビデオ信号に限定されるものではなく、パソコン等のディジタルデータでも良い。

【００１９】

【発明の効果】以上説明したようにこの発明によれば、同一レベルの入力信号に対して異なる印加電圧に変換する複数の変換方法により生成した複数の印加電圧を、画素に選択的に印加することにより、複数の変換方法の特性が視覚的に合成されるため、黒つぶれ現象や反転現象等の階調表示の悪化を低減し、液晶表示素子が大画面パネルであっても視覚特性を改善することができる。また、液晶表示素子の構成を変えることなしに視角特性を改善でき、特に「暗」表示域での反転現象の低減が可能

となるため、表示内容等用途により視角特性や解像度を要求が異なる液晶表示装置に、同一の特性，構成の液晶表示素子を用いることが可能となり、その実用的効果は大きい。

【図面の簡単な説明】

【図１】この発明の実施の形態の液晶表示装置の構成図。

【図２】この発明の実施の形態における電圧補正回路の入出力特性図。

【図３】この発明の実施の形態の液晶表示装置の入力のビデオ信号に対する輝度を示す図。

【図４】この発明の実施の形態において所定の画素毎に異なる電圧補正回路を選択するパターン例を示す図。

【図５】従来の液晶表示装置の構成図。

【図６】従来例における液晶表示素子のＶ－Ｔ特性図。

【符号の説明】

１０　増幅回路

２１Ａ，２１Ｂ　電圧補正回路

３１　駆動電圧回路

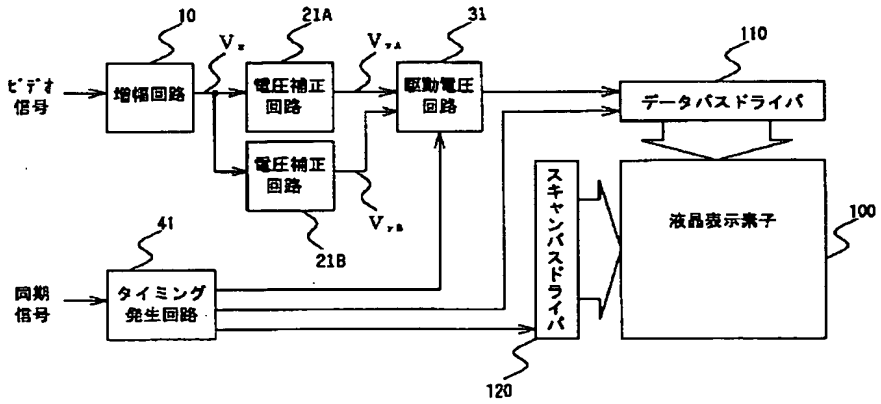
４１　タイミング発生回路

１００　液晶表示素子

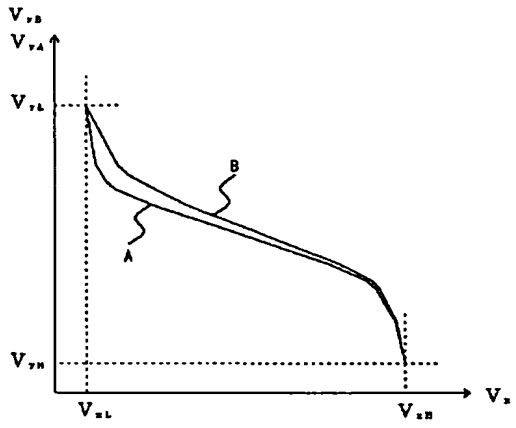
１１０　データバスドライバ

１２０　スキャンバスドライバ

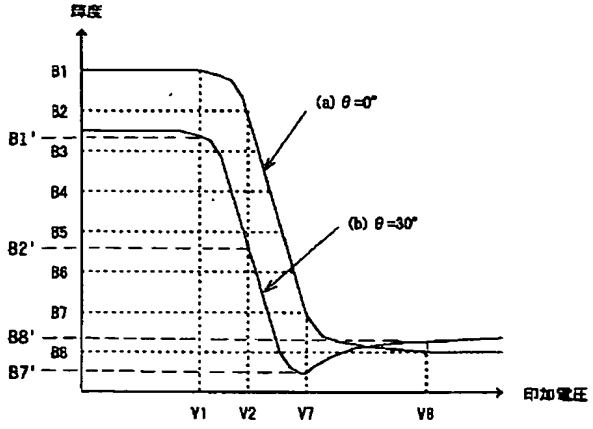
【図１】



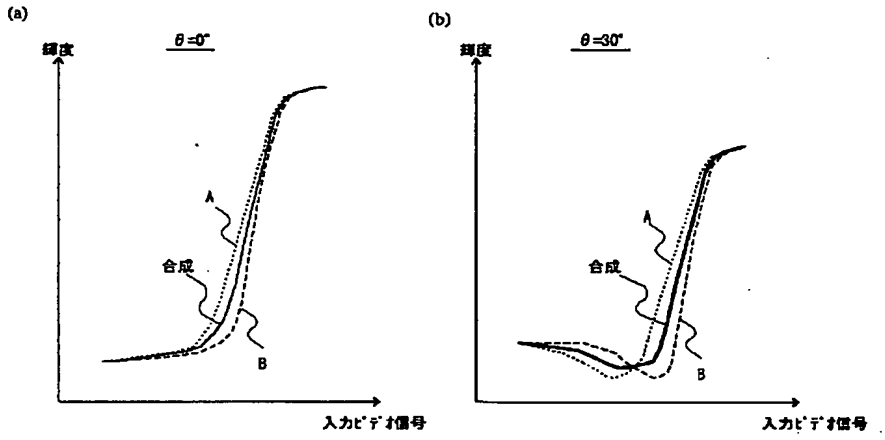
【図２】


B
A

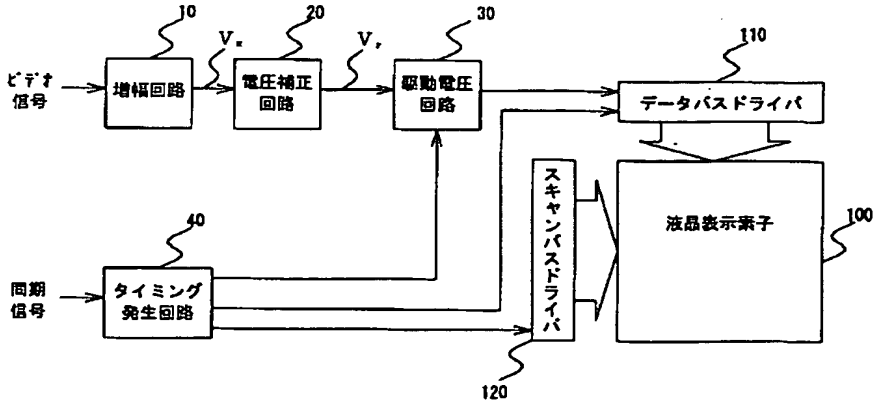
【図６】


輝度
B1
B2
B1'
B3
B4
B5
B2'
B6
B7
B8'
B8
B7'
(a) θ=0°
(b) θ=30°
V1
V2
V7
V8
印加電圧

【図３】


(a)
輝度
θ=0°
A
合成
B
入力ビデオ信号
(b)
輝度
θ=30°
A
合成
B
入力ビデオ信号

【図５】


10
20
30
110
ビデオ信号
増幅回路
電圧補正回路
駆動電圧回路
データバスドライバ
スキャンバスドライバ
液晶表示素子
100
40
同期信号
タイミング発生回路
120

【図４】